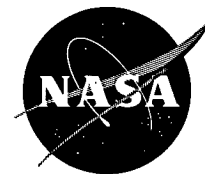
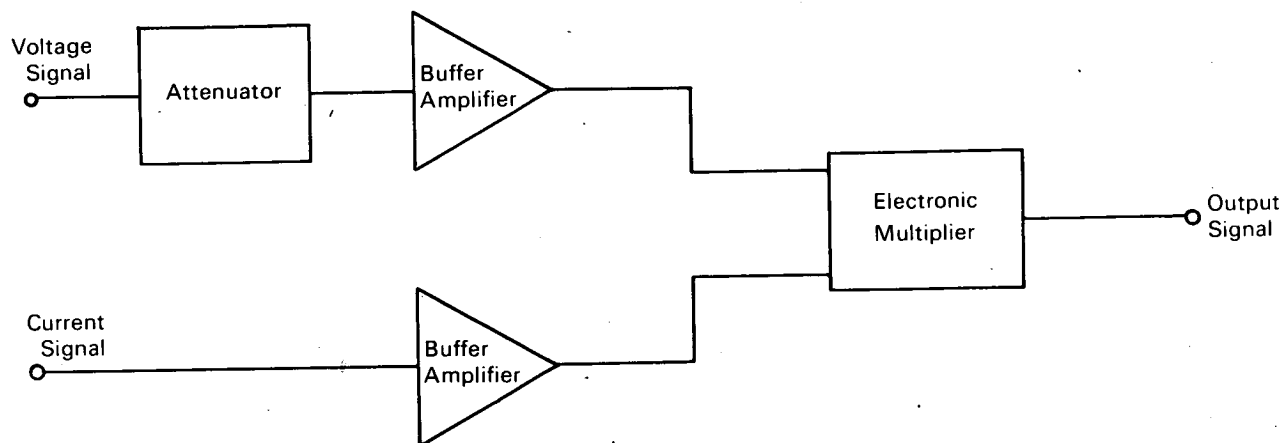


NASA TECH BRIEF



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High-Frequency Wattage-to-Voltage Converter



A solid state wattage-to-voltage converter was developed and tested. This device, which measures electric power over a wide frequency range, multiplies two electrical input signals to produce an output voltage that is proportional to their product. When the two input signals are proportional to the current and the voltage in the circuit being measured, the output voltage becomes proportional to the power.

Alternating current power is presently measured by devices such as the electrodynamicometer and induction-type wattmeters, the thermal converter, and the calorimeter. These devices serve their intended purposes, but they have basic limitations that restrict their scope of usefulness. These limitations are either a limited frequency range, long step response time, a large error with low power factor loads, high distortion waves or the consumption of a substantial amount of power from the circuit being measured.

The heart of the converter is an electronic analog multiplier. Multipliers have been used in analog computers, but until recently they have been limited by

relatively low frequency responses. Currently, the quarter-square type of multiplier has the most desirable characteristics and was selected for this device.

A block diagram of this system is shown in the figure. The current signal is produced by a commercially available current transformer that produces a 5V rms output signal at full scale current input. The voltage signal is fed into the appropriate attenuator such that the output of the attenuator is nominally 5V rms.

The multiplier multiplies the voltage from the attenuator and the voltage output from the current transformer and supplies the product (divided by 10) to the output terminals. Therefore, the average (dc) voltage at the output is directly proportional to the average power being measured. This can be read out on a digital voltmeter which averages voltage over a suitable period of time. Alternatively, the power can be instantaneously read out on an oscilloscope which will record the manner in which power varies with time.

(continued overleaf)

The following tests were conducted on the converter: (1) dc input voltage; (2) ac input voltage; (3) frequency response; (4) phase angle; (5) drift; and (6) rise time. The successful results of the tests substantiated the use of the analog multiplier as the basis for the converter.

Notes:

1. The device is capable of measuring power over a frequency range of dc to 15 kHz with an accuracy of 0.2% of full scale.
2. It can measure power in waveforms such as square waves, pulses, spikes, and rectified sine waves.
3. The following documentation may be obtained from:

Clearinghouse for Federal Scientific
and Technical Information
Springfield, Virginia 22151
Single document price \$3.00
(or microfiche \$0.65)

Reference:

NASA-TN-D-5674 (N70-18956), Design
and Performance of a High-Frequency
Wattage-to-Voltage Converter

4. Technical questions may be directed to:
Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B70-10049

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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